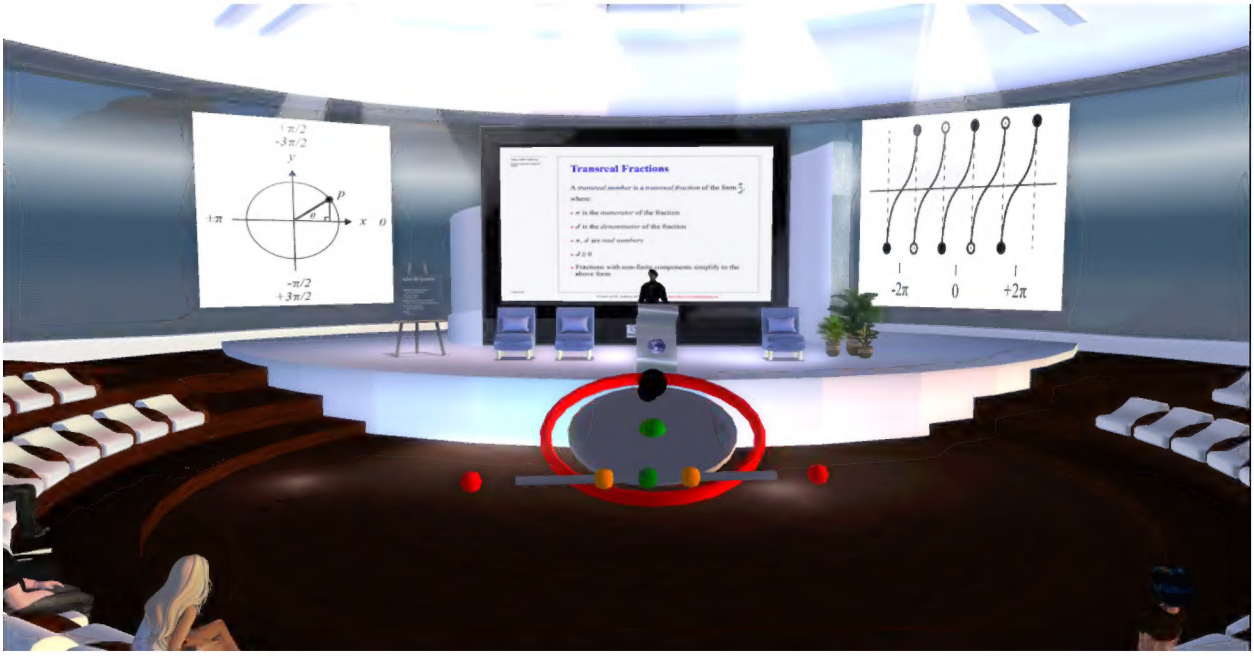


Nullity / James Anderson :

I call my arithmetics, where division by zero is allowed, "trans"-arithmetics. Adding this prefix helps me keep track of what is ordinary arithmetic and what has been extended.

Transreal arithmetic is discussed in Chapter 6 of the following history book. The central argument is that people have wanted to divide by zero ever since zero was invented, about one thousand years ago. For most of that time people thought it was possible but in the last one hundred and fifty years, or so, mathematical consensus was that it is impossible. However, the book notes, I proposed a solution which seems to be consistent. The book says I have yet to prove that dividing by zero is useful!

https://plus.google.com/110992073213775479658/posts/Q4nMEEAdYGQ

Since about the age of eight, I have deliberately sought to do paradigm breaking research. I am dyslexic so cannot compete with other scientists on the number of papers I read or write but I can think for myself and have a very competent visual imagination. I see solutions where others do not. By virtue of using visualisation, I automatically break out of the ordinary paradigms of science because these are all

written down and I use non-verbal reasoning! But this has its own problems: sometimes I find it very hard to translate the pictures in my mind into words! In short, I play to my strengths. My strength being my weakness – dyslexia!

Dyslexia also brings a second problem. I tend to take words too literally. In social circumstances this can be awkward but it has a benefit in science. If I read that a mathematical formula is such and such, but the author forgets to say that it does not hold when division by zero occurs, then I automatically assume it does works on division by zero.

Coping with dyslexia also brings a benefit. I was in my thirties before I learned to read accurately so, by that time, I had spent decades learning how to decode words. I now have the ability to see the symbols on the page, to manipulate them as raw symbols, and to interpret them for their meaning and then to manipulate the meaning both verbally and visually. That is how I arrived at transrational arithmetic. I took the formulas for manipulating fractions and applied them to symbols which could be zero. This approach is catalogued in a rather old presentation, which has now been surpassed in some details, but it does give an insight into my thinking:

http://www.bookofparagon.com/Mathematics/China_2009.pdf

A more focused tutorial on transreal arithmetic is given in the following paper but be aware that the approach to transcomplex arithmetic described there has now been surpassed:

https://plus.google.com/110992073213775479658/posts/h4arW1mgC93

The most up to date discussion of transcomplex arithmetic is in the following paper but be warned, this is still a work in progress! The paper has the merit that it has a human readable proof of the consistency of transcomplex and transreal arithmetics and of the

fact that transcomplex arithmetic contains transreal arithmetic which, in turn, contains real arithmetic and of the fact that transcomplex arithmetic contains complex arithmetic which also contains real arithmetic.

https://plus.google.com/110992073213775479658/posts/EqZB5teke98

The human proof is much easier to read than an earlier machine proof of consistency. The following paper gives a link to the machine proof files. It is worth noting that I got into computers because they are a way to deal with dyslexia. I make very many errors when writing but computers allow errors in programs to be corrected and then they do the hard work of re-doing all of the work – usually in a fraction of a second! This is so much easier than trying to write even a short letter, correctly, by hand.

https://plus.google.com/110992073213775479658/posts/akC7DCNqMga

The proof files, along with various other movies and downloads are here:

http://www.bookofparagon.com/Pages/Downloads.htm

I am now a computer scientist and set out to show that division by zero can be useful in computers. These two papers show how floating-point calculations are improved when the floating-point bits describe transreal arithmetic. The second paper also extends limits to transreal numbers which is the basis of extending calculus.

https://plus.google.com/110992073213775479658/posts/WMBtikCygii

The differential and integral calculus are extended to allow division by zero in the following paper but be aware that the transintegral calculus described there has now been surpassed.

https://plus.google.com/110992073213775479658/posts/isiyMpzwWY2

The first step in surpassing the transintegral calculus is described in the following draft paper.

https://plus.google.com/105989348762238088830/posts/S2PZXUUixJj

I have also extended Newtonian physics but have not managed to publish it. The essential insight is that a nullity force has no influence on the part of the universe that is described by finite or infinite co-ordinates so neither a nullity force nor a zero force can accelerate a mass: only positive and negative forces can do that. With that insight in place, the physicist who is competent in transmathematics can now solve problems in physics that rely on transreal arithmetic or the transdifferential or transintegral calculus but we have not yet extended vectors and differential geometry. There is still a lot of work to do in extending all of the mathematical tools that physicists use but we have done enough to allow the solution of some physical problems at singularities.

We have extended various logics by basing them on transreal arithmetic but be aware that the geometrical description of all possible worlds has now been surpassed.

https://plus.google.com/110992073213775479658/posts/jY4crSPqNAK

In order to equip myself to conduct paradigm breaking research, I read about how various mathematical, scientific and artistic paradigms were broken in the past. I did this by reading philosophy and books on the history of mathematics and science. The history books are very valuable to me because they summarise a great deal of technical work. Reading the summaries is much easier for me than reading vast volumes of primary work. I have also found that the foundational ideas in every area of science are essentially simple, or at least simpler than their modern development! By reading history, I get both a good overview of a subject and a grasp of its fundamentals. This gives me all I need to develop the fundamentals in a new direction and to apply them to the whole subject. I strongly recommend reading philosophy and history.

Initially I was the only person doing transmathematics. During the last one thousand years, since the invention of zero, about ten billion people have lived, or are alive now, so I counted myself as one person, who knew how to divide by zero, among a population of ten billion who did not know! After many years, I received an email from someone else who was using transreal arithmetic and who wanted to talk to me. Word spread from person to person. When there were seven of us in the email group, I told everyone that they were one in a billion people, as there are about seven billion people alive now. I celebrated this fact by moving the group to a Google+ community called Transmathematica. Four of the original people dropped out but we now number about fifty people, many of them academics but with quite a large proportion of people from other technical walks of life. When we get to seventy people, each person will be one in a hundred million!

https://plus.google.com/u/0/communities/103261551046378190173

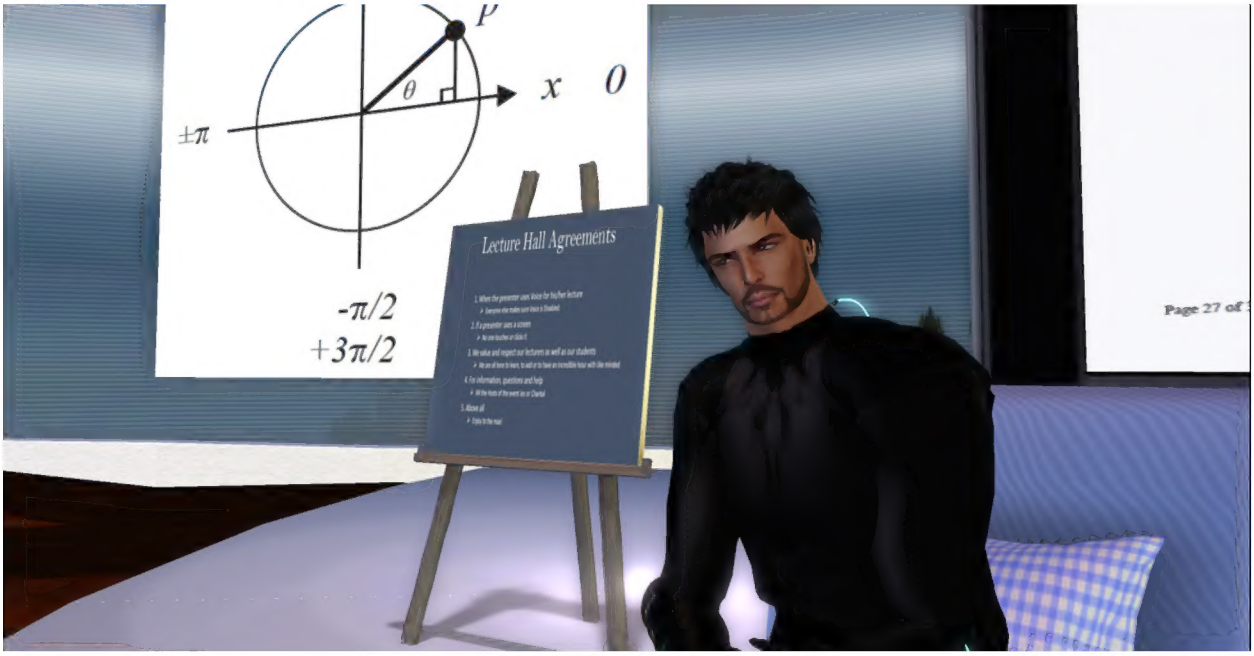
I see Transmathematica as a step toward building a "school" of people who are engaged in transmathematics. I encourage the building of this community whenever I can. I teach transmathematics at various universities around the world by using Skype or Google+ Hangouts. I even give talks in Second Life! I give talks in real life scientific conferences, business meetings, and in secondary schools. I am now setting up a scientific journal to publish papers on transmathematics, its applications and pedagogy. This is aimed at giving transmathematics a channel to move from paradigm breaking science to conventional science.

I have also designed a supercomputer that uses transreal arithmetic to allow programs to be executed very quickly. When I raise USD 25m, I will be able to startup a company to manufacture and sell this computer – delivering huge, practical advantages to people engaged in all manner of scientific, engineering and medical computations. I see this as one of the main demonstrations of the practical utility of being able to divide by zero.

I am also writing UK and European grant proposals to conduct research in transmathematics and transcomputation. I see this as a way of exploring its usefulness.

I am very happy to talk to anyone about any aspect of transmathematics so do email me if you have something to ask or to say.

Dr James Anderson
james.a.d.w.anderson@btinternet.com



Local Text Chat:

Nullity (thenumbernullity): History book:
https://plus.google.com/110992073213775479658/posts/Q4nMEEAdYGQ
Ţulpa (jes.cobalt): YAY!
Ţulpa (jes.cobalt): Hi5
Vic Michalak: Yay!

Vic Michalak: Can you basically explain what happens when you divide by zero?
Vic Michalak: What type of number is the result?
Nullity (thenumbernullity): When you divide by zero the result is a non-finite number: any positive number divided by zero is positive infinity; any negative number divided by zero is negative infinity; and the missing number, zero divided by zero is nullity.

Infinities have been defined before, as limits and cardinalities, the new definition is different from these in that it defines the infinities and nullity as fractions. This approach, too, has been taken many times in the history of mathematics but my infinities and nullity have some new properties that have not been anticipated by other authors, even modern authors who have defined zero divided by zero in other algebraic contexts. I believe the definition of nullity is the first to define real zero divided by real zero as a number.
Ţulpa (jes.cobalt): :))))
Vic Michalak: nulidade
Vic Michalak: (looked it up)

Nullity (thenumbernullity): Transmathemtical:
https://plus.google.com/u/0/communities/103261551046378190173

Tutorial on transreal arithmetic:
https://plus.google.com/110992073213775479658/posts/h4arW1mgC93

Machine proof of consistency:

https://plus.google.com/110992073213775479658/posts/akC7DCNqMga

Human proof of consistency of transcomplex numbers:
https://plus.google.com/110992073213775479658/posts/EqZB5teke98

Transreal limits; tangent has period 2π:
https://plus.google.com/110992073213775479658/posts/WMBtikCygii

Transreal differential and integral calculus:
https://plus.google.com/110992073213775479658/posts/isiyMpzwWY2

Paraconsistent logics:
https://plus.google.com/110992073213775479658/posts/jY4crSPqNAK

Floating-point arithmetic:
https://plus.google.com/110992073213775479658/posts/WMBtikCygii

Vic Michalak: Nice to have the 'number line' visualization
Vic Michalak: My rice steamer can divide by zero? ㋡
Nullity (thenumbernullity): Sadly no - it may use fuxzzy logic but withiout division by zero
Vic Michalak: My cat certainly uses fuzzy logic (see also the cartoon "Get Fuzzy")...but I digress...
Vic Michalak: The set of all possible worlds must include Second Life and OpenSim, etc...
ArråwAndBåw (arrowandbow): hahaha

Vic Michalak: Serious question: Is this possibly used in describing parallel universes?
Vic Michalak: For example, the infinities associated with black holes, etc... (may be outside of this topic)
Nullity (thenumbernullity): Let's take this in parts. I'll start with an answer from Logic and then build up to an answer from Physics.

It is possible to construct a logical space of all possible worlds as follows. Firstly map dialetheic truth values. i.e. truth values which may be both true and false, onto the transreal number line so that: all positive numbers model more true than false, and positive infinity is completely, i.e. classically true; all negative numbers model more false than true, and negative infinity is completely, i.e. classically, false; zero models equally true and false; nullity models gap values that have no degree of truth or falsehood. Now take the set of all possible propositions, indexed by integers, and associate each proposition with a transreal number line, laid off as axes of a (trans)-Cartesian coordinate frame. The points in the space are distinct possible worlds that characterise the truth value of every possible proposition.

This logical space has a cardinality that is exactly enough to model all possible propositions written in a discrete language, as logicians write them!, and exactly enough to model every possible world (combination) of these propositions. There is a one-to-one mapping between the points in the space and logically possible worlds. If a higher cardinality is wanted, say to model all possible worlds of a continuous real-numbered values, then it can be constructed by indexing over larger sets.

Constructing a space of dialetheic possible worlds is one way of constructing paraconsistent logics, i.e. logics which allow contradictions, but there is another way. It is possible to partition the space into consistent propositions. In this way, one can a partition all of the propositions

that are consistent in a particular logical universe, such as a logical model of a physically parallel universe.

It is possible to do more. One can develop a mathematical model of the physics of an entire universe in a partition and relate partitions to each other. For example, one can differentiate across partitions of possible worlds to discover, for example, how quickly one physical constant changes its value or to find the turning points where one physics changes into another.

Black holes are a rather more concrete example of this. Let's start with a thought experiment and then consider what we would have to do to make it more realistic.

Suppose that we have two massive, same charged, point particles, such as tau leptons. Let's imagine that they are in exactly the same place then there is an infinite gravitational attraction and an infinite electrostatic repulsion between them. Ordinary mathematics cannot compute the resultant force but transreal arithmetic can – the resultant is nullity. As nullity lies outside the extended-real number line, from minus infinity to positive infinity, there is no component of a nullity force in the extended-real universe so nullity forces have no effect on that part of the universe. Our particles are free to move but have no force compelling them to move. But, as they are microscopic particles, their position undergoes a stochastic, quantal, perturbation. Once they are separated, the electrostatic force dominates the gravitational force and the particles separate.

Let's imagine that the two particles are in the same place, exactly at the singularity of a black hole. The particles leave the singularity and, if they do not cross the event horizon, they fall back into the singularity in a convection current. The event horizon tracks the mass in the convection current so it is not a perfect sphere but roils, in time with the stochastic convection current. This crinkly, roiling event horizon has a bigger surface area than a perfect sphere of the same mean radius so I predict that real black holes evaporate faster than predicted by Hawking radiation from a perfectly spherical event horizon.

If the processes that gave rise to our universe, in the big bang, continue to operate in black holes, then material in the singularity might inflate beyond the event horizon. In this case, too, the black hole will evaporate faster than would otherwise be predicted.

I suggest that if black holes can be produced in particle accelerators then they will evaporate faster than predicted by Hawking radiation from a perfectly spherical event horizon.

This process might be observed astronomically. If gas falls into a black hole then it should be heated non-linearly with its distance from the singularity as it comes under the influence of

convected or inflated mass. Sadly, the convection currents, arising from quantal effects, might be too small to notice! But with the entire mass of the black hole convecting the effect might be noticeable.

No one expects fundamental particles to survive at the high energies at a singularity in a black hole but we can still make some predictions, on the assumption that transreal arithmetic holds at a singularity. We can predict that a nullity force can give rise to infinite attractive and repulsive forces, so we expect, for example, inverse square laws, we also expect forces to operate opposite to each other, for example as in Newton's laws, so that infinite forces sum to nullity, and we expect attractive forces to be weaker than repulsive ones so that material can leave a singularity in a creation event.

Vic Michalak: Getting past infinities is a very exciting prospect!
Vic Michalak: As was said, we need to be able to calculate what happens in a singularity to explain what happens at the beginning of the universe - it is a great mathematical achievement to be able to do this!
Vic Michalak: So the Schwarzschild radius is not a perfect sphere but has fluctuations?
Nullity (thenumbernullity): Yes
Vic Michalak: Mini-black holes would be nasty on Earth
Vic Michalak: I think it is all very fascinating what the human mind can imagine and our capacity for solving problems in imaginary ways....
Vic Michalak: blah blah blah is a technical mathematical term...
Nullity (thenumbernullity): Any other questions?

Vic Michalak: What inspired you to arrive at this math?
Vic Michalak: [Must be using Fortran... for millions of digits]
Vic Michalak: Was it was when you considered this geometrically that you had a definable "aha" point (no singularities) when you knew you had a different and workable solution?
Vic Michalak: [I started with FORTRAN very long ago...]
Vic Michalak: It must have been very gratifying to make this discovery?
Vic Michalak: How did you celebrate? Did you run tell someone who would understand? Or break open a bottle of champagne? ツ
Nullity (thenumbernullity): Personally it was very gratifying though I have run into an extraordinary degree of anti-intellectual resistance to, and obstruction of, my work, for a couple of decades. It is very tiresome, damaging to me, and damaging to everyone who could benefit from division by zero. The world would be a better place, if my critics gave sound reasons to substantiate their resistance and justify their obstruction.
There was only one person in my department that I could talk to about this. We later collaborated on the first machine proof of the consistency of transreal arithmetic.
I will open a bottle of champagne when my work is recognised.
Vic Michalak: Actually describing bubbles forming and popping is an interesting math/physics problem, if I recall... (I am neither, but I remember reading about this)
Vic Michalak: I appreciate the work that went into this presentation!!!
Chantal (nymf.hathaway): Nullity I have received the request for your return to do a follow up... how would that be?
July Juneau: yes thanks a lot
Vic Michalak: It really takes someone who knows what they are talking about to explain it to people who do not! ツ
Areyn Laurasia: Feels like I should read more before I ask any questions :)
Leo Mandelbrot: No questions, because I didn't know what Transmathematics is. Thanks for the intro.
Chantal (nymf.hathaway): Nullity please read the text chat back
Vic Michalak: I would like to be clever in math as well, but it just was not one of my fortes.. alas
Chantal (nymf.hathaway): People just learn this type of maths for the first time
Vic Michalak: Thank you again for taking the time and effort to present for us on this fascinating topic!
Ţulpa (jes.cobalt): :))) Marvelous presentation, Nullity
Leo Mandelbrot: That sounds good, gives us a chance to catch up
July Juneau: bye
Areyn Laurasia: Thank you

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Jes & Chantal Sept 2014